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ABSTRACT

The lack of standardization in research involving pictorial variables has made it difficult to clarify the functions of pictorial stimuli in learning. This study sought to determine whether selected methods of rendering pictorial illustrations influenced the number and type of descriptive words evoked in a verbal association task. Normally the verbal responses evoked by a pictorial stimulus may be ranked as to frequency, with high frequency (called high dominance) associated with ease in learning. Experimental results indicated that color photographs elicited significantly more descriptive responses than black-and-white photographs, which in turn did better than line drawings. Both the stimulus objects were factors in determining the number and type of verbal responses elicited. The results affirm the need for developing standardized materials for studying concept learning with pictorial materials. (RB)

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MODE OF PICTORIAL RENDITION AND ASSOCIATED RESPONSE TENDENCIES

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Introduction

Despite the widespread use of pictures in instruction and the current interest in visual literacy, little is known about how pictorial materials contribute to learning. The lack of standardization in research involving pictorial variables has made it difficult to clarify the functions of pictorial stimuli in learning. Researchers seeking to understand the functions of pictorial illustrations in learning are in much the same position as those who studied verbal conceptual behavior prior to the development of standardized verbal stimulus materials and experimental procedures.

In this study, verbal responses evoked by a series of pictures were collected and the dominance levels (Underwood and Richardson,1965a) of these responses were determined. Underwood and Richardson (1956b) have shown the dominance level of associated verbal responses to be a significant factor influencing performance in concept learning tasks employing verbal stimulus materials. Their work indicates that a common response for a series of stimuli will be discovered rapidly if it is strongly associated with (high dominance) each stimulus in a series. If a common response is weakly associated with (low dominance) each stimulus in a series, concept attainment will require more time or more trials.

Several researchers (Karwoski, et al, 1944; Otto 1962, 1964; Bourisseau et al 1965, 1967; Deno, et al, 1968) have compared verbal associations evoked by verbal and pictorial stimuli. The results of these studies indicate that; (1) verbal responses to verbal and pictorial stimuli vary in frequency along a range that can be labled high, medium, and low dominance, (2) pictures of objects and word names of objects do not always elicit the same number or type of verbal responses, and (3) attributes of stimulus objects (color, shape, size) vary as responses with the mode of presenting the object (word or picture).

This study sought to determine whether or not selected methods of rendering pictorial illustrations influenced the number and type of descriptive words (adjectives) evoked in a verbal association task. A series of pictures which varied systematically in degree of visual correspondence to stimulus objects represented was developed. Verbal associates evoked by the pictures were recorded and analyzed for purposes of determining whether or not significant differences existed between or among the total number and type of responses evoked and the methods of rendering a picture or the stimulus objects being represented.

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Procedures

The statistical design used was an AXB factorial with repeated measures on factor B (Winer, 1962). There were three levels of factor A, mode of rendering the stimulus objects: line drawings, continuous tone black and white photographs, and color photographs. There were twenty levels of factor B, the stimulus object being represented: apple, tack, fish, etc.

Subjects.

The subject population consisted of approximately 350 upper division education majors enrolled in an audiovisual course at Arizona State University. Ninty subjects were randomly selected and randomly assigned to one of three experimental treatments: color photographs, black and white photographs, or line drawings. Thirty subjects were assigned to each treatment. The series of pictures were administered to three different groups of subjects within each treatment condition.

Materials.

The stimulus materials consisted of pictures of 20 objects randomly selected from a list of 89 concrete nouns. The nouns were the type commonly used in verbal concept learning tasks. Each object had the following characteristics; it was capable of being named or labeled, its name was commonly used as indicated by word frequency counts, it was capable of being manipulated in the photographic facilities available.

Each object was photographed against a white background from an angle that would produce a three-quarter view. A lighting ratio of 2:1 between the main light and the fill light was used. Each object was photographed on Anscochrome T100, a film that produces a full color transparent image in a 2"X2" slide format. The resulting color transparencies were copied on Kodak DP402, a film that produces a direct positive continuous tone black and white transparent image in a 2"X2" slide format. Transparent line drawings in the 2"X2" slide format were produced in the following manner. The color transparencies were projected onto 8"X10" sheets of white paper, the outline and other distinquishing features of the object were traced in black ink. The tracing was copied on Kodak M417 high contrast film. Each set of transparencies differed uniformly in the degree to which it corresponded to the objects being represented. All other visual factors were controlled within and between each set of transparencies.

Before using the transparencies in the experiment, each set was presented to a sample of the population to determine whether or not the objects pictured could be appropriately named. Names given by the subjects were considered appropriate if they were the same as, synonymous with, or more generic than those the experimenter intended to elicit. Synonymous or generic names were used to designate the objects if they occurred with greater frequency than the intended names. All of the pictures used in the experimental study were appropriately named by at least eighty-five percent of the sample. Subjects used in this developmental phase did not participate in the experiment.

Experimental Procedures

The subjects were given instructions designed to produce a set for giving responses that described the object being presented. The responses elicited were adjectives that described how the object looked, smelled, tasted, felt, or sounded.

Each picture series was presented to one of the three groups of subjects within each treatment condition. The pictures were randomly resequenced for each of the three presentations within treatments to control for the effects of sequence runs, interitem interaction, and subject fatique. The pictures were presented at the rate of one every thirty seconds. During the time each picture appeared on the screen, the subject wrote as many descriptive words as possible on note pads provided. A separate page was used to record the responses to each object presented.

The experimenter and two assistants tabulated and categorized the responses. If a response was judged to be descriptive of the way an object looked, smelled, tasted, felt, or sounded it was counted. Inappropriate responses, such as object names or chain associates were not counted. A Spearman rank order correlation coefficient (Siegel, 1956) was computed for observer rankings of responses to a common set of pictures. The lowest coefficient of correlation for any pair of rankings was .83, $p < .01$. Tabulated responses were assigned to classes of descriptive words. The categories used were shape, color, taste, tactile, olfactory, size, and sound. Responses describing the size or sound of the objects presented occurred with such low frequencies that no effort was made to analyze their differences.

Results

Responses elicited by two of the stimulus objects presented in the three treatment conditions are reported in Table 1. Responses that were not descriptive and responses that occurred with less than five percent frequency are not reported. The numbers indicate the percentage of subjects in each treatment who emitted each response. Some shifts in dominance levels of responses are indicated across treatments.

Table 1

Percent Frequency of Responses to Color, Black and White, and Line Pictures.

Stimulus	Responses	Percent Frequency C	B/W	L	Stimulus	Response	Percent Frequency C	B/W	L
Apple	red	97	77	80	Fish (Minnow)	Shiny	60	30	17
	yellow	-	-	10		long	30	34	-
	shiny	40	73	10		moist	27	23	27
	round	70	77	33		scaly	67	83	63
	juicy	50	47	47		slimy	57	50	63
	firm	13	13	17		soft	13	-	-
	smooth	27	37	30		rough	-	23	10
	crisp	13	13	13		smelly	20	20	27
	sweet	17	37	27		cold	-	20	27
	sour	-	10	10					
	tasty	13	13	29					

Two factor repeated measures analysis of variance (Winer, 1962) was performed on the total number of responses evoked and on the number of selected classes of responses evoked. Summary data for the analysis of the total number of descriptive responses evoked by stimulus object and mode of rendition is reported in Table 2.

Table 2

Analysis of Variance of Total Number of Responses Evoked

Source	Sum of Squares	df	Mean Square	F
Between subjects	895.44	89		
A (Mode of Rendition	104.21	2	52.11	5.73**
Subjects within groups	791.23	87	9.09	
Within subjects	1898.50	1710		
B(Stimulus-Objects)	252.12	19	13.27	13.27**
AXB Interaction	48.21	38	1.27	1.31
BX Subjects within groups	1598.17	1653	0.97	

** P .01

A Newman-Keuls test was performed on the differences between means on the mode of rendition factor. The results indicated that color photographs elicited significantly ($p < .05$) more descriptive responses than black and white photographs or line drawings. Black and white photographs elicited significantly more ($p < .05$) descriptive responses than line drawings.

Two factor repeated measures analysis of variance was performed on select classes of descriptive responses: color, shape, tactile, and taste. The stimulus object, factor B, produced significant differences in each class of response analyzed. To some extent differences attributed to the objects presented may be due to the differential sensitivity of tests on the between and within subject differences. No post hoc comparisons were made to determine which stimulus objects produced more responses. The mode of rendition, factor A, produced significant differences in the number of color responses elicited and in the number of shape responses elicited (Tables 3 and 4). Only one of the interactions (AXB) produced significant differences in any of the response classes analyzed, that was color (Table 3).

Table 3
Analysis of Variance of Color Responses

Source	Sum of Squares	df	Mean Squares	F
Between Subjects	188.36	89		
A (Mode of presentation	65.35	2	32.67	23.11**
Subjects within groups	123.01	87	1.41	
Within Subjects	505.40	1710		
B(Stimulus Object)	80.69	19	4.25	17.52**
AXB Interaction	23.99	38	0.63	2.60**
BXSubject within groups	400.72	1653	0.24	

** p .01

Table 4
Analysis of Variance of Shape Responses

Source	Sum of Squares	df	Mean Squares	F
Between Subjects	286.04	89		
A(Mode of Rendition	55.52	2	27.76	10.48**
Subjects within groups	230.52	87	2.65	
Within Subjects	1181.90	1710		
B(Stimulus Object	285.39	19	15.02	28.70**
AXB Interaction	31.30	38	0.82	1.57
BX Subjects within groups	865.21	1653	0.52	

** p .01

A Newman-Keuls test indicated that color photographs elicited significantly more ($p < .05$) color responses than line drawings or black and white photographs. Other differences in the number of color responses elicited were not significant.

Results of the Newman Keuls test on the mean number of shape responses elicited indicated that color photographs and black and white photographs elicited significantly more ($p < .05$) shape responses than line drawings. The difference between the mean number of shape responses elicited by black and white photographs and color photographs was not significant.

Discussion

The results of this study affirm the need for developing standardized materials for studying concept learning with pictorial materials. The stimulus objects presented and the mode of rendering those objects were both shown to be significant factors in determining the number and type of verbal responses elicited by pictorial stimuli.

The pictorial materials developed for this study represent a standardized set of stimuli which can be used in studying conceptual behavior. The response data collected for each picture provides a list of discriminable stimulus attributes and their associated dominance levels. When the collection of scaled illustrations approaches the number of verbal materials available it will be possible to investigate a number of basic questions regarding the function of illustrations in concept learning.

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